

purposes they are quite frequently used. These bushings are not commonly used as removable bushings, as it would take considerable time to unscrew, and to again insert, a bushing of this type into the jig body.

Special Designs of Guide Bushings. ~~ When the guide bushings are very long, and consequently would cause unnecessary friction in their contact with the cutting tools, they may be recessed, as shown in Fig. 13. The distance A of the hole in the bushing is recessed enough wider than the diameter of the tool so as not to bear on it. The length B , being about twice the diameter of the hole, gives sufficiently long guiding surfaces for the cutting tool, to prevent its running out. If the outside diameter of the bushing is very large compared with

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Fig. 13.

Fig. 14-

Fig. 15.

the diameter of the cutting tool, as indicated in Fig. 14, the expense of making the bushings may be reduced by making the outside bushing of cast iron, inserting into this a hardened tool-steel bushing, driven in place. The steel bushing is then given dimensions according to Table 1 for stationary bushings. The reason why there may be a necessity of a bushing having so large an outside diameter and so small a hole may be that the bushing is required to be removed for counterboring part of the small hole being drilled by a eounterbore of large diameter, in which case the hole in the jig body has to be large enough to accommodate the large eounterbore.

If a loose or removable bushing is longer than the lining bushing, as illustrated in Fig. 15, it will prove advantageous to have the diameter of the projecting portion of the bushing about $\ll V$ inch smaller in diameter than the part of the loose bushing which